Clinical Update

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Location of the second mesiobuccal canal of maxillary molars in endodontic therapy

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Purpose

A source of great frustration associated with the endodontic therapy of maxillary molars is whether or not a second mesiobuccal canal (MB2) exists, and to what extent should practitioners go in pursuit of locating it. The mesiobuccal (MB) root of maxillary molars has generated much research and clinical investigation within the past ten years. Recent research has shown that a large percentage of MB roots contain two canals. Therefore, one should *always assume that two canals exist* in the MB root until careful examination proves otherwise. The purpose of this *Clinical Update* is to review the literature and provide the clinician with the tools and techniques to locate and treat the MB2 canal.

Historical findings

Historically, studies on the incidence of the MB2 canal in maxillary molars have ranged from 36% to 54% (1,2,3). Weine, et al. were one of the first to acknowledge that the failure of endodontic treatment of maxillary molars is likely due to the failure to locate, instrument, and fill the MB2 canal. By sectioning 208 MB roots, they discovered a second canal in the MB root of maxillary first molars 51.5% of the time. Fourteen percent of the teeth had two MB canals with separate apices (4). A similar range of findings has been seen in maxillary second molars. Pomeranz and Fishelberg conducted both in vitro and in vivo investigations. They determined that the MB root of a combined group of maxillary first and second molars was found to contain secondary canals in 69% of the teeth studied in vitro, and in 31% of the teeth studied in vivo (5).

Findings from the past decade

With advances made both in the fields of research and in clinical dentistry, the methods for identification of the MB2 canals have become more sophisticated. Techniques involving scanning electron microscopy (SEM) of extracted teeth, as well as the clinical use of long-shank burs, headlamps, ultrasonic handpieces, and dental operating microscopes have significantly increased the percentage of MB2 canals identified. Kulild and Peters found that 54.2% of the teeth contained an MB2 canal that was easily found and entered by an instrument. Another 31.3% were located with the judicious use of long-shanked round burs used in a mesial and apical direction. An additional 9.6% could be located under a microscope, indicating a total of 95.2% of MB roots contained two canals (6). An SEM investigation by Gilles and Reader yielded 90% of extracted maxillary first and second molars with MB2 canals (7). Fogel et al. found 71.2% of MB2 canals clinically treatable in 208 maxillary first molars with the aid of surgical microscopes and headlamps and by creating a modified access preparation (8). Additionally, approximately one-third of the MB2 canals in the latter two studies exited the root in separate foramina from the main MB canal. Stropko found the MB2 canal in 73.2% of first molars, 50.7% of second molars, and in 20.0% of third molars in a pool of 1,732 maxillary molars conventionally treated over an 8½ year period. However, as the operator became more experienced, scheduled sufficient clinical time, routinely employed the dental operating microscope, and used specific instruments adapted for microendodontics, MB2 canals were located in 93.0% of first molars and 60.4% in second molars (9). From the increased numbers demonstrated by these studies concomitant with the use of more advanced instrumentation, it is even more prudent to be suspect of an MB2 canal, especially with a large number of them existing as completely separate canal systems from the main MB canals.

Other anatomic considerations

There are several reasons why the MB2 canal is challenging to locate and negotiate. Developmentally, there is often a *dentinal cornice*, or rounded growth of dentin, found in the middle of the mesial surface of the pulp chamber which conceals entry into the MB2 canal (10). Likewise, during development due to dentin deposition, the ML area of the MB root first moves slightly mesially and lingually, exiting at a distance of about 1.8mm from the MB canal (6). The MB1 canal normally departs the pulpal floor with only a slight mesial inclination. However, the MB2 canal usually has a marked mesial incline immediately apical to its orifice in the coronal 1 to 3mm. When an attempt is made to instrument the MB2, the tip of the file tends to catch against the mesial wall of the canal, preventing apical progress. Finding and instrumenting the MB2 canal can be made more difficult due to the fact that the canal is usually smaller and can become calcified over time when exposed to irritants such as mesial proximal caries and deep restorations.

Useful clinical aids

Just how can one increase the likelihood of successfully locating and treating the MB2 canal? First of all, as seen in the recent studies, magnification is paramount. Either a dental operating microscope or dental loupes are highly recommended. A rhomboidal access preparation should be made in contrast to the triangular form traditionally taught (Figure 1). This will allow access to the area just mesial to

an imaginary line drawn from the MB orifice to the palatal orifice and will allow the necessary mesially-directed shaping. Often, *subpulpal grooves*, or developmental grooves on the pulpal floor, will provide a roadmap between the funnel-shaped entries to the canals (10). Other aids to enhance visualization may include a "champagne or bubble test" provided by NaOCl in the chamber, staining the chamber with methylene blue dye, transillumination, the use of sharp explorers, location of bleeding points, and horizontally angulated preoperative radiographs (11). An indication of the MB2 orifice may also be a discolored dot lingual to the MB canal. Once this dot is identified, careful planing of the mesial wall of the chamber may reveal the mesial course of the MB2 canal just before it courses apically (6). After locating the MB2 orifice, use of long-shanked small round burs (LN® by Dentsply Maillefer or Mueller® burs by Brasseler) or ultrasonic ditching tips inclined mesially will allow an "unroofing" of the overlying calcified tissue. This refinement of the access preparation allows a more desired straight line access to the MB2 canal. Care should be taken in exploring the area mesial to the main MB canal with ultrasonics and long-shanked burs. ***Indiscriminate troughing can result in perforations.***

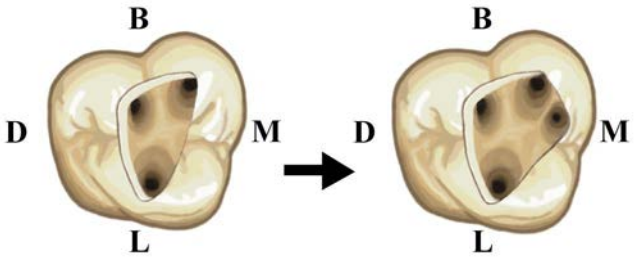

Figure 1 Preparation should be rhomboidal in shape to allow adequate access to the MB2 canal (Drawing courtesy of the Medical Media Department, Naval Medical Education and Training Command)

Conclusions

It is generally accepted that a major cause for failure of root canal therapy is an inability to recognize the presence of, and to adequately treat, all of the canals in the root canal system. Although there have been no studies documenting the success-failure of therapy associated with maxillary molars, specifically in relation to the ability to locate and treat the MB2 canal, Wolcott et al. recently found a statistically significant increase in the incidence of MB2 canals between initial treatments and retreatments, suggesting that failure to find and treat existing MB2 canals will decrease the long-term success (12). Therefore, it is worthwhile for the practitioner to put the time and effort into properly locating and treating these canals in an attempt to increase the prognosis of endodontic therapy in maxillary molars.

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